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Chrysanthemum Gall Midge

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CHRYSANTHEMUM GALL MIDGE

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The chrysanthemum gall midge (*Diarthronomyia hypogaea* Low) has been a persistent and serious pest of greenhouse chrysanthemums. Occasionally it is found on hardy varieties growing out-of-doors but more generally it is considered a greenhouse pest in the United States and southern Canada.

All commercial chrysanthemums of both the single and pompon varieties may be attacked by the insect; some, however, are more susceptible to injury by the midge than others. Varieties with light-green foliage appear to be more attractive to the chrysanthemum midge than those with deeper hues.

Description of Injury

When severe infestation of chrysanthemum midge occurs, most of the leaves, stems and flower heads of plants may be affected. The leaves assume a misshapen, dwarfed, curled and knotty appearance. Stems are twisted and bent and the flowers are deformed, stunted and for the most part completely ruined. With lighter infestations, deformation of the plants may not occur to any noticeable extent.

At the onset of an infestation, greenish blister-like galls develop on affected plants. Later, as the galls mature, they become cone-shaped in appearance and project obliquely from the upper surface (occasionally from the lower surface) of the leaves and from the stems. The position of a gall on the upper surface of a leaf may be indicated by a slight swelling on the lower surface or vice versa. Under conditions of extreme crowding, the galls may be densely clustered on the stems and flower heads. Galls average about 1/12 inch in length.

Life History and Habits

Adults of the chrysanthemum gall midge are about 1/14 of an inch long, reddish to orange-yellow in color, and extremely delicate in appearance with long slender legs and two frail wings. Orange-colored eggs are deposited, usually at the top of the new growth, on the upper surface of the tender new foliage and stems. As the eggs hatch, the larvae bore into the plant tissue. The irritation thus caused results in the development of the galls. As the insects feed and mature, the galls increase in size. Pupation takes place in the galls from which the adults emerge, thus completing a life cycle of about five weeks under most greenhouse conditions. When fully developed and

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shortly before splitting down the back to release the adult, the pupa pushes itself ½ to ¾ of its length out of the gall. After the adults emerge, the empty pupal skins are left protruding from the galls. Observations indicate that the midges do not begin to emerge until after midnight and cease doing so at or just before daybreak. Egg laying usually occurs during the morning hours from daylight until noon. The comparatively short life cycle of about 35 days makes possible the development of a number of generations a year in greenhouses.

Adult gall midge laying eggs on chrysanthemum stem. Enlarged three times.

Early Control Measures

Soon after the chrysanthemum midge was discovered in this country, experiments conducted by the U. S. Department of Agriculture (2) showed that nightly fumigation of greenhouses for a period of at least six weeks with nicotine papers or hydrocyanic-acid gas destroyed all adult midges and thus prevented egg laying and the development of additional generations of the pest. When it was not practical to fumigate, sprays of nicotine sulfate and soap were used.

Recent Control Measures

Smith, Fulton and Lung (1) report that DDT or parathion aerosol treatments are effective in controlling chrysanthemum midges. They gave no description of their tests, but implied that the treatments killed only adult midges and therefore repeated applications were required.

Experiments in Control

A serious outbreak of chrysanthemum midge occurred in greenhouses in New Haven in the spring of 1951. It was reported that the infestation originated with badly infested stock plants brought into the greenhouses during early April. By late May nearly all of almost 100 varieties of greenhouse and hardy chrysanthemums of both the single and pompon types were infested to some extent. Many of the cuttings were so completely stunted by excessive gall populations that rooting was inhibited and general deterioration was taking place. Counts showed that there was an average of 24 galls per leaf, the range being from 4 to 60.

The varieties Dr. Englehard, Pink Globe, Single Lavender, Yellow Persons, Snow White, Double Lavender, China Rose, White Turner, Crystal White and Tuxedo were more seriously injured than others. Dr. Englehard and Tuxedo were so badly infested that their removal and destruction was

proposed. It developed later, as a result of the success of the experiments, that such a drastic measure was unnecessary.

Materials and Methods

In view of the success achieved in controlling the birch leaf miner and boxwood leaf miner with lindane emulsion, this insecticide was selected for trial against the chrysanthemum gall midge. Its past behavior indicated that it had potentialities for destroying the immature stages of the midge (in the galls), as well as emerging and dispersed adults.

Chrysanthemum cuttings four to five inches long had been taken from the stock plants during the first week in May and planted in three-inch rows in washed sand in benches four feet wide. The distance between the rows was about four inches. The greenhouse temperature was maintained at 65° to 70° F. Under these conditions rooting was completed in four to six weeks.

Twenty-one of the most seriously infested varieties of chrysanthemums, including the 10 listed heretofore, were selected for treatment. They had been in the greenhouse for about four weeks when the experiment was started. At this time it was estimated that about 35 per cent of the midges were in the pupal stage, 60 per cent in the larval stage, and 5 per cent had emerged as adults.

There were 15 rows of cuttings in each treatment of lindane at dosages of 1 to 800, 1600, 3200 and 6400. Spray treatments were applied for the first time on May 31 using a three-gallon hand-operated pressure sprayer with extension rod and adjustable fine spray nozzle attachments. Both the upper and lower surfaces of the leaves and the stems of the cuttings were sprayed. The treatments were made in mid-morning on cloudy days. In order to assure a quick clean-up of the infestation, a second series of lindane treatments was made on June 5.

Sampling

Each of the 21 varieties of chrysanthemums in the experiment was sampled on June 8 by picking 10 infested leaves at random from the cuttings in the bench. Sixteen leaves were taken from the checks or untreated varieties. All of the galls on each leaf were opened under a binocular microscope and the larvae, pupae or empty pupal skins removed to determine percentage of midge mortality.

Results

An examination of the chrysanthemum foliage after the first series of treatments was applied indicated no foliage injury by lindane at any dosage level of the insecticide. Moreover, no injury to the foliage appeared following the second series of treatments.

Shortly after the first treatment, it was seen that some of the midges at the 1 to 800 treatment were affected by the lindane. Although counts were not made at this time, it appeared that adult midges were destroyed in the

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process of emerging and for the most part issued only part way before becoming affected by the insecticide. Dead adults with fully expanded wings were likewise seen adhering to the foliage. Perhaps some of them had emerged prior to the use of the insecticide, and were present on the foliage at the time of treatment, or returned subsequently and died from the effect of lindane residue. Counts were made of the number of dead adults with fully expanded wings found on 24 chrysanthemum leaves picked at random. There was an average of 2.2 per leaf, ranging from 1 to 5.

Examination of Table 1, in which the counts have been summarized, shows that lindane used at dosages of 1 to 800, 1600 and 3200 was highly effective in destroying larvae, pupae and adults of the gall midge. Two pupae in one leaf treated with lindane at 1 to 800 were not killed. This may be explained by the fact that, despite the thoroughness with which the treatments were applied, an occasional leaf may have escaped complete coverage. When used twice at the dosage of 1 to 6400, lindane did not destroy all of the insects present in chrysanthemum galls. Some of the larval and pupal stages were unaffected by this treatment.

Table 1. Results of Lindane Treatments to Control Chrysanthemum Gall Midge Under Greenhouse Conditions. Galls on Ten Leaves Were Examined Per Variety of Chrysanthemum. June 8, 1951.

Av. No. Galls Per Leaf	Average Number of Dead			Av. No. Empty Galls	Live Larvae or Pupae
	Larvae	Pupae	Adults		
		Lindane 1-800			
10.5	1.3	6	0	3.7	
27.2	1.5	11.7	0.2	13.8	
13.4	8.2	4.4	0.1	1.1	
29.6	16.1	10.1	0	3.4	
6.2	2.1	2.9	0	1.3	
4.1	0.1	0.7	0.3	3.0	
22.5	3.5	8.3	0.2	10.4	2 pupae
		Lindane 1-1600			
20.2	8.3	6.7	0.1	5.2	
7.5	1.0	0.9	0	5.6	
21.0	4.8	1.8	0	14.4	
20.1	9.0	5.1	0.1	5.9	
21.3	2.8	7.0	0.3	11.5	
		Lindane 1-3200			
9.9	9.1	0.8	0	0.1	
26.6	18.8	4.8	0	3.0	
46.5	39.3	4.9	0	2.3	
4.4	0.2	0.8	0.4	3.0	
14.5	8.9	4.0	0.1	1.5	
		Lindane 1-6400			
24.2	1.8	9.1	0	12.4	1 larva, 1 pupa
20.7	5.3	8.9	0.1	6.1	4 larvae
9.1	1.1	1.2	0	6.8	1 larva
22.0	2.9	9.9	0.5	8.2	8 larvae, 3 pupae
		Untreated Checks (Average of 16 Leaves)			
10.1	*	*	*	1.18	

* With the exception of 1 dead pupa and the 1.18 average of empty galls, all of the remaining galls contained living larvae.

Summary

Two applications of lindane 25% in emulsion form, at a dilution of 1 to 3200 or stronger, killed a very large proportion of larvae and pupae of the chrysanthemum gall midge while they were still in the galls. Many dead adults were observed on the treated leaves. This treatment was sufficient to control a serious infestation of the midge in a commercial greenhouse.

Suggestions for Control

Chrysanthemum gall midge may be controlled by spraying infested plants or cuttings with lindane emulsion at the rate of one pint in 100 gallons of water (a teaspoon per gallon). Wettable powder may be substituted for the emulsion at the rate of 1 to 1.5 pounds per 100 gallons of water (4.5 to 7 gm. per gallon). It would appear that two sprays at about 5 to 7 day intervals may give more complete control than one. Perhaps under some conditions a third spray may be necessary. Lighter infestations may be checked permanently by picking the affected leaves from the plants and destroying them.

In addition, all plants or cuttings brought into the greenhouse should be carefully inspected. In the event an infestation is discovered, the affected material should be disposed of or treated. Such precautionary measures will prevent further spread which could prove costly in the stunting of plants and consequent reduction in flowering.

Literature Cited

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